Title: Videobusters

Brief Overview:

Students will utilize fundamental properties of matrix arithmetic to solve real-world situations. They will also integrate prior knowledge of matrices with TI-83 graphing calculators.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate the ability to problem solving approaches to investigate and understand matrices.

- **Mathematics as Communication**
  This activity provides the opportunity for students to reflect and clarify what they have learned about matrices and how to interpret real-world data.

- **Mathematics as Reasoning**
  Students will organize and analyze data sets and demonstrate their understanding of basic matrix operations.

- **Mathematical Connections**
  Students will use technology and matrices to model real-life data.

- **Algebra**
  Student will perform basic addition, subtraction, multiplication, and scalar multiplication of matrices.

- **Statistics**
  Students will organize and analyze data.

Links to Maryland High School Mathematics Core Learning Goals

- **1.2.5**
  The student will apply formulas and use matrices to solve real-world problems.

Grade/Level:

Grades 9-12; This lesson can be applied to Advanced Algebra I and above.

Duration/Length:

Two to three class periods (variable)

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Using terms such as profit, revenue, and percentage markup
- Placing real-world data into matrix format
- Performing scalar multiplication
- Adding, subtracting, and multiplying matrices
- Transposing matrices

Objectives:

Students will be able to:

- organize and analyze real-world data using matrices.
- add, subtract, multiply, and perform scalar multiplication of matrices.

Materials/Resources/Printed Materials:

- Appendix with calculator instructions
- Worksheet with data and questions
- TI-82/83 graphing calculators
- TI-82/83 overhead calculator
- Teacher notes

Development/Procedures:

- Lesson will take one 90 minute or two 45 minute periods.
- Students will be broken into groups of 3 or 4.
- Each group will receive an activity package and asked to read through the scenario.
- Teacher will instruct each group to work on Question 1 together.
  Note: Students' methods of solving problem may vary.
- Teacher will guide students through Question 1, utilizing matrices and encouraging as much class discussion as possible.
- Groups will be allotted time to complete activity packets.
  Note: Teacher might need to review rounding and its relevance to the given data.
- Teacher will collect one activity package from each group for assessment.

Extension/Follow Up:

Teacher may use similar activity but change the data set and type of real-world situation. Teacher can utilize similar or more complex matrix operations as desired.

Authors:

Rachelle Andrews
Parkdale High School
Prince George's County, MD

Robert Hyman
Gaithersburg High School
Montgomery County, MD

Jennie Burgee
Elizabeth Seton High School
Archdiocese of Washington

VIDEOBUSTERS

Videobusters, a chain retailer of videos and DVDs, is experiencing growing pains. Knowing rate of sales will help keep track of inventory, when and what to re-order and what quantities, and expected revenue. The owners are being overloaded with data and need a way to organize the information so they can better manage their business. You have been hired as a consultant to help.

The inventory for two of the stores is listed below in table A according to price codes that represent the cost for videos and DVDs. Table B is a list of prices that correspond to each price code.

For calculator instructions see Appendix A. Round all decimal answers to nearest whole number.

TABLE A

	STORE 1		STORE 2	
PRICE CODE	VIDEOS	DVD'S	VIDEOS	DVD'S
A	75	20	65	10
B	80	25	70	15
C	90	45	80	70
D	120	50	110	100
E	150	55	140	130
F	100	30	90	80

TABLE B

	PRICE GUIDE	
CODE	VIDEO	DVD
A	5.49	10.99
B	8.99	13.99
C	12.99	18.99
D	15.99	20.99
E	20.99	23.99
F	25.99	27.99

Videobusters Activity Worksheet

Names: **Date:**

1. Use Table A and Table B to answer the following questions. Be sure to show **ALL WORK.**

   A) Find the total inventory of both stores for videos based on price code.

   B) Find the total inventory of both stores for DVDs based on price code.

2. During an average week, 8% of videos and 13% of DVDs from each price category are sold in both stores. Assume that your answer in question 1 is the inventory at the beginning of the week. **(REMINDER, ANSWER NEEDS TO BE IN MATRIX FORMAT)**

   A) In total, how many videos and DVDs of each price code will be sold during an average week in Store 1 and Store 2 ?

   B) What will be the remaining inventory of videos and DVDs of each price category at the end of that week ?

3. Given that the two stores sold 8% of their videos and 13% of their DVDs, what will be the total revenue for each store after one week?

   A) For videos?

   B) For DVDs?

4. In order to free up space, Videobusters wants to reduce its initial inventory more quickly than usual. The owners have decided to have a 20% sale off the price of Videos and DVDs for one week. The owners will give the manager of each store 15% of the total revenue made at their store during that one week sale.

Use the initial inventory from Table A. If the result of the sale is a 10% reduction in inventory in each store of Videos and DVDs from each price code, what is the bonus earned by the manager of each of the two stores?

5. Videobusters' regular prices are set from a percentage markup based on the cost to the store from their wholesaler. The percent markup is the same for Store 1 and Store 2. What is the expected profit made by each store in an average week? For % markup see Table C.

Table C

Price Code	% Markup
A	**13**
B	**43**
C	**73**
D	**24**
E	**74**
F	**45**

Appendix A
TI-82 and 83 Calculator Instructions

1) Turn calculator on.

2) Set dimensions of matrix [A]:
[MATRIX] ->[EDIT] ->[A] ->[ENTER] -># rows ->[ENTER] ->[# columns] ->[ENTER]

3) Set and store elements in matrix:
Complete step 2, then enter numeric value for element in row 1, column 1 - **[ENTER]** (at this point, enter elements across one row, typing **[ENTER]** after each entry. Once first row is complete, continue to next row) Then you MUST type **[2nd] ->[MODE]** to save entries.

4) To enter additional matrices, type **[MATRIX] -> [EDIT] ->** then arrow down or press the number of the desired matrix, then continue to f**ollow steps 2 and 3** to enter any additional matrices necessary.

5) Calculations:

a. Addition of matrix [A] and matrix [B]:
Complete steps 2 - 4.
[2nd] ->[MODE] (to clear screen).
[MATRIX] ->[A] ->[ENTER] ->[+] ->[MATRIX] ->[B] -> [ENTER].
The result will be the sum of matrix A and matrix B, provided their dimensions are the same.

b. Subtraction of matrix [A] and matrix [B]:
Follow steps in 5a, changing the [+] to [-]

c. Multiplication of matrix [A] and matrix [B]:
Follow steps in 5a, changing the [+] to [*]

d. Transpose of a matrix [A]:
[MATRIX] ->[A] ->[ENTER] ->[MATRIX] ->[MATH] ->[T] ->[ENTER] ->[ENTER]

Videobusters Activity Worksheet

Answer Key

VIDEOBUSTERS

Videobusters, a chain retailer of videos and DVDs, is experiencing growing pains. Knowing rate of sales will help keep track of inventory, when and what to re-order and what quantities, and expected revenue. The owners are being buried in data and needs a way to organize the information so they can better manage their business. You have been hired as a consultant to help.

The inventory for two of the stores is listed below in table A according to price codes that represent the cost for videos and DVDs. Table B is a list of prices that correspond to each price code.

For calculator instructions see Appendix A.

TABLE A

	STORE 1		STORE 2	
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A	75	20	65	10
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C	90	45	80	70
D	120	50	110	100
E	150	55	140	130
F	100	30	90	80

TABLE B

	PRICE GUIDE	
CODE	VIDEO	DVD
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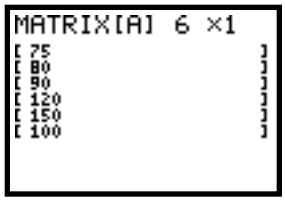
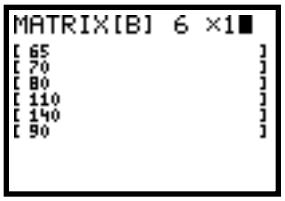
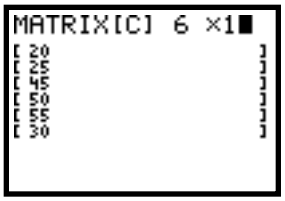
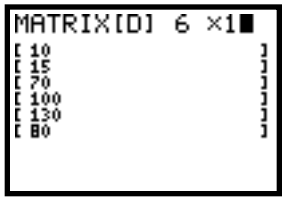
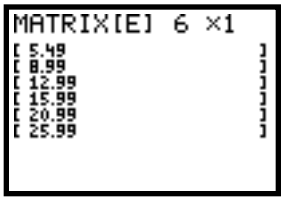
B	8.99	13.99
C	12.99	18.99
D	15.99	20.99
E	20.99	23.99
F	25.99	27.99

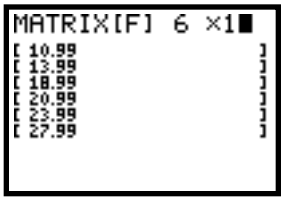


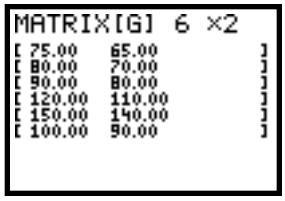


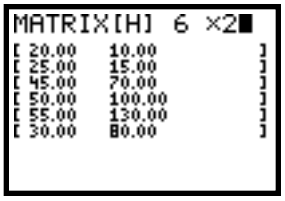






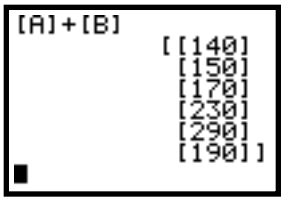






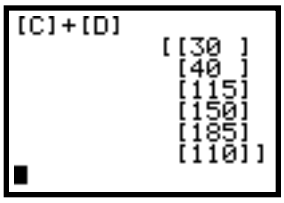
1. Use Table A and Table B to answer the following questions. Be sure to show **ALL WORK.**

A) Find the total inventory of both stores for videos based on price code.



= TiV

B) Find the total inventory of both stores for DVDs based on price code.



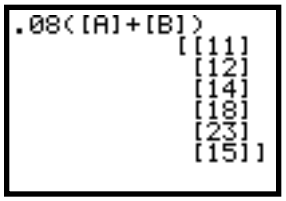
=TiD

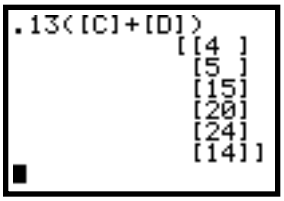
2. During an average week, 8% of videos and 13% of DVDs from each price category are sold in both stores. Assume that your answer in question 1 is the inventory at the beginning of the week. **(REMINDER, ANSWER NEEDS TO BE IN MATRIX FORMAT)**

Volume of Video = (8%)(Total inventory of Video) or VV=8%(TiV)

Volume of DVDs = (13%) (Total inventory of DVDs) or VD= 13%(TiD)

A) In total, how many videos and DVDs of each price code will be sold during an average week in Store 1 and Store 2 ?

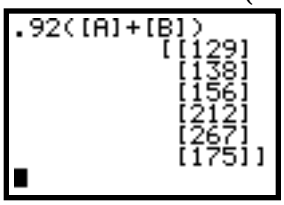
VV= 

VD= 

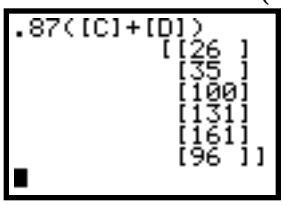
B) What will be the remaining inventory of videos and DVDs of each price category at the end of that week ?

Answers are rounded to the nearest video or DVD. This may be a good point for discussion: Why are fractional answers inappropriate here?

.92 TiV or TiV-VV (Videos)



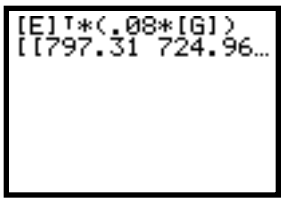
.87 TiD or TiD-VD (DVDs)



3. Given that the two stores sold 8% of their videos and 13% of their DVDs, what will be the total revenue for each store after one week?

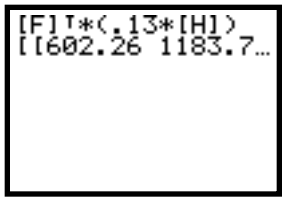
Price = 1X6 matrix of the cost of video's in each price group
Volume Sold = the volume of Video's sold as a 6X2 matrix with the rows representing each price code and the columns representing the inventory of each store.
Video Revenue = Price of video X 8% Volume of Video sold
VR= PV x 8% VVS
DVD Revenue = Price of DVD X 13% Volume of DVDs sold
DR= PV x 13% VDS

A) For videos?



= VR

B) For DVDs?

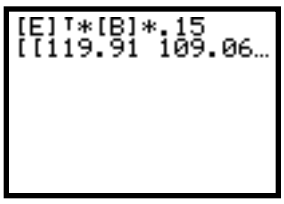


=DR * *note: the cents were cut off the complete answer is $602.26, $1183.77*

4. In order to free up space, Videobusters wants to reduce its initial inventory more quickly than usual. The owners have decided to have a 20% sale off the price of Videos and DVDs for one week. The owners will give the manager of each store 15% of the total revenue made at their store during that one week sale.

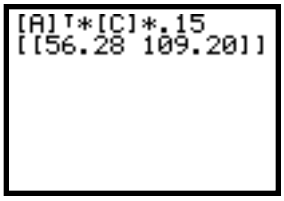
   Use the initial inventory from Table A. If the result of the sale is a 10% reduction in inventory in each store of Videos and DVDs from each price code, what is the bonus earned by the manager of each of the two stores?

Video Revenue = (20 % off the Price x 10% off the Volume Sold x .15)



**Store 1 video revenue is $119.91 and Store 2 Video revenue is $109.06*

DVD Revenue= (20% off the Price x 10% off the Volume Sold x .15)



** Store 1 DVD revenue is $56.28 and Store 2 DVD revenue is $109.20*

The total bonus earned for each manager is: *Store 1: $119.91 + $56.28 = $176.19*
Store 2: $109.06 + $109.20 =$218.26

5. Videobusters' regular prices are set from a percentage markup based on the cost to the store from their wholesaler. The percent markup is the same for Store 1 and Store 2. What is the expected profit made by each store in an average week? For % markup see Table C.

Table C

Price Code	% Markup
A	**13**
B	**43**
C	**73**
D	**24**
E	**74**
F	**45**

This question asks the students to derive a series of matrix operations to get profit or loss from the given data. It's important that the students know they are being asked for the <u>difference</u> between the total costs of videos and DVDs and the total revenue produced from their sale.

VC-VR or DC-DR

Remember VR and DR were found in question three.

The logic is as follows: *1) Product Cost = $\frac{\text{Product Price}}{1+\%\ \text{Markup}}$*

2) Cost = Product cost x Volume sold

3) Profit = Cost - Revenue

For Videos:

PC =

```
MATRIX[A] 6 ×1
[ 4.86          ]
[ 6.29          ]
[ 7.51          ]
[ 12.90         ]
[ 12.06         ]
[ 17.92         ]
```

Cost= PC x

```
MATRIX[B] 6 ×2
[ 6.00    5.00  ]
[ 6.00    6.00  ]
[ 7.00    7.00  ]
[ 10.00   8.00  ]
[ 12.00   11.00 ]
[ 8.00    7.00  ]
```

=

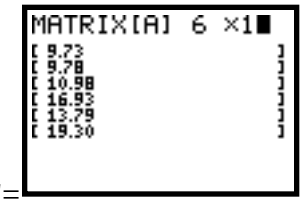
```
[A]ᵀ*[B]
[[536.55 475.91…
```

Profit =

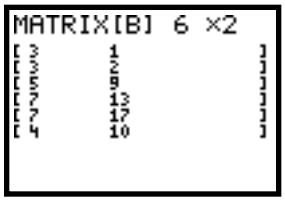
```
[A]-[C]
[[260.76 249.05…
```

For DVDs:

PC=



Cost = PC x



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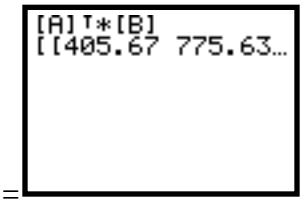
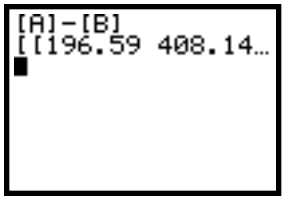


Profit =



Performance Assessment

Teacher's Guide

Introduction

The purpose of the Assessment Activity is to provide feedback so that appropriate instructional decisions can be made. The assessment is based on application of objectives included in the Videobusters activity involving matrices.

Objectives Covered

This task assumes that your students have received instruction and have successfully completed the Videobusters activity which is based on the following concepts and/or objectives:

- Demonstrates an understanding of addition, multiplication, and scalar multiplication of matrices
- Demonstrate the knowledge of using real-life data with matrix format
- Apply formulas and matrices to solve real-world problems

Tools/Materials Needed for Assessment:

Per student, copy of task, pencil or pen, TI-82 or TI-83 graphing calculator, and scrap paper.

Administering the Assessment

This assessment should take approximately 60 minutes.

Distribute the necessary materials to each student.

SAY: *For this period, you are going to use some of the things you have learned in the Videobusters activity. Today you will work independently to complete the activities in the assessment, "The Pantstore." Read the Introduction to yourselves.*

SAY: *Are there any questions? You may begin.*

Collect students' work and materials at the end of the class period.

Performance Assessment

Student Response Sheet

Videobusters Assessment **Name:**

DIRECTIONS: Using the methods you learned in the activity, "Videobusters," answer the following questions using the data from Tables A and B. SHOW ALL WORK FOR FULL CREDIT!

INTRODUCTION:

The Pantstore, a clothing retail store, is experiencing problems stocking their stores with enough inventory. The managers are being overloaded in data and need a way to organize the information so they can better manage their businesses. You have been hired as a consultant to help.

The inventory for two of the stores is listed below in Table A according to price codes that represent the cost for pants. Table B lists the prices that correspond to each price code.

TABLE A

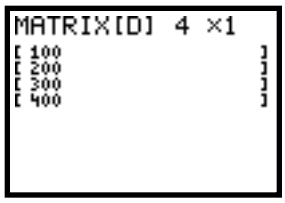
PRICE CODE	STORE 1	STORE 2
A	75	85
B	60	70
C	40	50
D	100	110

TABLE B

PRICE CODE	PRICE
A	$39.99
B	$50.00
C	$10.99
D	$12.99

1. Using matrices, determine the total inventory of pants in each price code for both stores. Represent your answer as a matrix and show all work for full credit.

2. In an average month, 10% of pants from each price category are sold at each store. Assume that the total inventory of the two stores, by price code, is represented below by Matrix D. What is the total number of pants sold from the two stores during the month? Represent your answer in matrix format and show all your work to earn full credit.



3. What would the total revenue be for store #1 during an average month?

A) $887.76

B) $7737.85

C) $773.79

D) $8877.55

4. What would the total revenue be for store #2 during an average month?

A) $887.76

B) $7737.85

C) $773.79

D) $8877.55

5. Assume that the mark up on each pair of pants in every store is 13% for each price category. Calculate the profit made by each store if store 1 had a revenue of $673 and store 2 had a revenue of $687. Show all work to earn full credit.

Performance Assessment

Scoring Guide

Videobuster Assessment **Name:**

DIRECTIONS: Using the methods you learned in the activity, "Videobusters," answer the following questions using the data in Tables A and B. SHOW ALL WORK FOR FULL CREDIT!

INTRODUCTION:

The Pantstore, a clothing retail store, is experiencing problems stocking their stores with enough inventory. The managers are being overloaded in data and need a way to organize the information so they can better manage their businesses. You have been hired as a consultant to help.

The inventory for two of the stores is listed below in Table A according to price codes that represent the cost for pants. Table B lists the prices that correspond to each price code.

TABLE A

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A	75	85
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TABLE B

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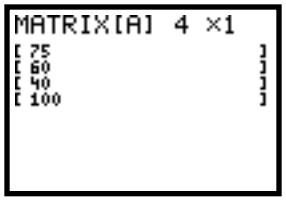
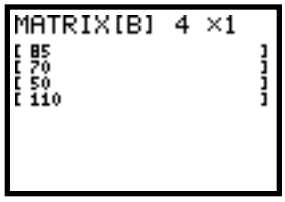
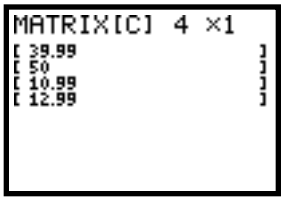
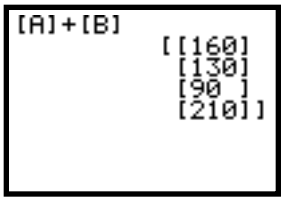






1. Using matrices, determine the total inventory of pants in each price code for both stores. Represent your answer in matrix format and show all work to earn full credit.



RUBRIC:

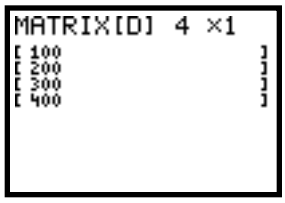
3- Student is able to take real-world data from a table and place into matrix format. They are able to accurately perform addition of matrices.

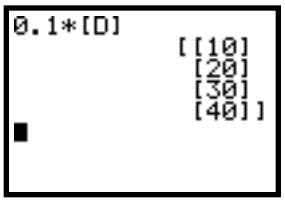
2- Student incorrectly used real-world data and did not place it into matrix format. Student was able to perform addition of matrices and may have a numerical error.

1- Student incorrectly used real-world data and did not place it into matrix format and did not perform addition of matrices.

0- All other responses.

2. In an average month, 10% of pants from each price category are sold at each store. Assume that the total inventory of the two stores, by price code, is represented below by Matrix D. What is the total number of pants sold from the two stores during the month? Represent your answer in matrix format and show all your work to earn full credit.





RUBRIC:

3- Student was able to accurately scalar multiply matrices. Student was able to place answers into matrix format.

2- Student was able to scalar multiply matrices and may have a numerical error or student was not able to correctly place answers into matrix format.

1- Student was not able to scalar multiply matrices and was not able to place answers into matrix format.

0- All other responses.

3. What would the total revenue be for store #1 during an average month?

A) $887.76

B) $7737.85

C) $773.79

D) $8877.55

4. What would the total revenue be for store #2 during an average month?

A) $887.76

B) $7737.85

C) $773.79

D) $8877.55

5. Assume that the mark up on each pair of pants in every store is 13% for each price category. Calculate the profit made if store 1 had a revenue of $673 and store 2 had a revenue of $987 in an average month. Show all work to earn full credit.

Total Revenue for Store 1 = $673	Total Revenue for Store 2 = $987
X = Profit Store 1	Y = Profit Store 2
1.13X = 673	1.13Y = 987
X = $595.58	Y = $873.45

Answer: [595.58 873.45]

RUBRIC:

3- Student was able to accurately calculate each store's profit. The student divided by 1 + % mark-up (1.13).

2- Student was able to calculate each stores profit but calculations are inaccurate. Student followed the correct procedure but divided by an incorrect value.

1-Student attempted the problem and did not follow the correct procedure to divide the revenue by 1.13.

0- All other responses.